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# USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

## VOLUME 60 UH-1N IN-FLIGHT CREW NOISE

NOVEMBER 1975

Approved for public release; distribution unlimited

AEROSPACE MEDICAL RESEARCH LABORATORY  
AEROSPACE MEDICAL DIVISION  
Air Force Systems Command  
Wright-Patterson Air Force Base, Ohio 45433



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FOR THE COMMANDER

  
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Director  
Biodynamics and Bionics Division  
Aerospace Medical Research Laboratory

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standard Air Force ear protectors. Refer to Volume 1 of this handbook, USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application, AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

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## **PREFACE**

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 72310418, Measurement of Noise and Vibration Environments of Air Force Operations. Col Justus F. Rose, Jr. conducted the field measurements and performed the data analysis; Capt Nick Farinacci prepared this report.

The authors acknowledge the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.

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## INTRODUCTION

The UH-1N is a USAF utility helicopter configured as a gunship and manufactured by the Bell Helicopter Company. Power is provided by two T400-CP-400 (PT6T-3) turboshaft engines rated at 1,800 shp at 6,600 rpm maximum take-off power. Both engines drive a two-blade 14.69 m main rotor and a two-blade 2.59 m diameter tail rotor. The engines are manufactured by the United Aircraft Corporation, United Aircraft of Canada, Ltd.

This volume provides measured data defining the bioacoustic environments produced inside this helicopter. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the UH-1N helicopter.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. *Refer to Volume 1* (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

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1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

## IN-FLIGHT NOISE

### MEASUREMENTS

All noise measurements were made on-board a standard-configured UH-1N helicopter during typical speed, altitude, and flight maneuver conditions. These levels describe the standard UH-1N environments, but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at one flight crew location with the right and left rear doors open. Table 1 lists the measurement location and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone was randomly moved external to the headgear in a region 0.2-0.3 meter from the head and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level that effectively smooths out short-duration fluctuations and best describes the exposure.

### RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the UH-1N helicopter at the specified location. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1  
MEASUREMENT LOCATION AND TEST CONDITIONS

UH-1N, Eglin AFB, 4 Aug 1971  
Serial # 69-6605

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Between Pilot and Copilot	Seated Head Level
CONDITION *	DESCRIPTION	
A	Ground power unit operating.	
B	#1 engine start, ground power unit operating.	
C	#2 engine start, #1 engine running, ground power unit operating.	
D	Engine RPM — 80%, Engine torque 10%, transmission torque 20% (will be shown as 10/20).	
E	Taxi (in ground effect) — 90% RPM, 25/50.	
F	Takeoff — 92% RPM, 35/70.	
G	Cruise — 90 KIAS, 90%, 25/50, 600' Altitude.	
H	Cruise (blade slap) — 70 KIAS, 90%, 20/40, 800' altitude.	
I	Cruise (blade slap) — 80 KIAS, 88%, 22/44, 800' altitude.	
J	Gunnery (7.62 mm minigun) — 2000 rounds/min — 80 KIAS, 90%, 30/60.	
K	Left rocket pod firing (2 rockets) — 110 KIAS, 70%, 0/0, Descent to target.	
L	Left rocket pod firing — same conditions as K.	
M	Gunnery (7.62 mm minigun) — 100 KIAS, 90%, 30/60.	
*	Right and left rear door open during all measurements.	



TABLE 1 (Continued)

## MEASUREMENT LOCATION AND TEST CONDITIONS

UH-1N, Eglin AFB, 4 Aug 1971

Serial # 69-6605

CONDITION*	DESCRIPTION
N	Right rocket pod firing — 90 KIAS, 90%, 30/60.
P	Right rocket pod firing (2 rockets)— gunnery (7.62 mm minigun), 80 KIAS, 90%, 25/50.
Q	Gunnery (7.62 mm minigun) — firing rate 2000 rounds/min., 90 KIAS, 90%, 25/50, 300' altitude.
R	Same as Q — firing rate 4000 rounds/min.
S	Gunnery pass (7.62 mm minigun) — Forward to aft gun swing, 90 KIAS, 90%, 25/50.
T	Rocket and gunnery pass (3 rockets) — firing rate 2000 rounds/min., 100-120 KIAS, 90%, 30/60.
U	Descent and Landing, 90%, 30/60.

\* Right and left rear door open during all measurements.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)												IDENTIFICATION:
2												OMEGA 3.2
												TEST 71-014-061
NOISE SOURCE/SUBJECT:												RUN 01
UM-1N HELICOPTER												10 JAN 75
INFLIGHT NOISE LEVELS												PAGE F1
FREQ (HZ)	LOCATION/CONDITION											
	1/A	1/B MIN	1/B MAX	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	
25	67	76	94	95	100	104	107	114	110	111	116	
31.5	73	75	97	99	101	106	107	109	108	108	110	
40	71	72	94	99	94	93	98	106	103	103	105	
50	71	77	93	94	98	99	101	101	99	98	103	
63	68	74	89	93	97	100	98	99	101	101	113	
80	84	75	88	92	94	99	93	100	99	100	111	
100	87	83	87	88	98	95	93	97	97	95	102	
125	71	75	79	82	94	91	88	92	94	90	105	
160	74	76	81	83	93	96	92	90	97	89	114	
200	78	77	83	85	95	96	90	90	98	90	114	
250	76	79	83	85	92	94	87	89	91	88	118	
315	73	76	78	81	91	91	84	87	88	86	115	
400	66	77	82	81	91	91	84	87	88	86	114	
500	70	77	81	84	89	90	84	87	87	86	115	
630	68	77	78	82	90	91	89	90	89	89	117	
800	67	73	87	84	88	90	85	88	86	86	118	
1000	63	70	81	90	86	87	85	87	85	86	115	
1250	62	68	76	79	85	85	83	88	83	84	117	
1600	64	66	77	79	91	90	88	89	86	87	118	
2000	64	68	75	82	83	83	81	86	82	84	121	
2500	60	65	74	79	81	81	79	83	79	82	117	
3150	57	65	73	77	84	84	81	83	80	82	116	
4000	57	65	74	79	80	79	78	81	78	80	117	
5000	53	63	76	79	78	76	75	78	75	77	115	
6300	51	65	84	83	81	78	77	78	76	77	114	
8000	53	60	82	88	86	83	80	80	82	82	114	
10000	49	58	69	77	84	86	86	81	80	81	110	
12500	45	60	67	73	87	81	80	80	79	80	110	
16000	45	59	67	73	83	79	78	79	79	79	109	
OVERALL	90	89	102	105	108	111	111	116	114	114	130	

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)													IDENTIFICATION:	
2														
NOISE SOURCE/SUBJECT:													OMEGA 3.2	
( OPERATION:													TEST 71-014-061	
(													RUN 02	
( UM-1M HELICOPTER													10 JAN 75	
( INFLIGHT NOISE LEVELS														
(													PAGE F2	
LOCATION/CONDITION														
FREQ														
( HZ)														
25	112	114	117	110	110	113	114	112	113	107				
31.5	110	114	115	107	108	117	109	115	112	107				
40	105	108	111	104	103	115	109	113	105	102				
50	103	104	104	105	101	103	105	103	104	98				
63	104	109	111	104	105	110	119	111	107	101				
80	108	111	110	107	107	110	114	112	108	101				
100	103	106	111	100	107	116	115	116	113	96				
125	98	105	106	99	101	111	121	112	106	90				
160	98	105	111	100	102	114	115	114	105	93				
200	100	106	113	105	105	115	123	117	108	96				
250	98	105	112	107	107	116	118	113	108	90				
315	101	110	114	107	106	117	117	115	111	89				
400	102	109	117	109	108	120	119	116	113	88				
500	102	113	117	108	108	120	117	116	113	89				
630	108	115	117	113	109	121	123	117	115	88				
800	107	116	116	113	106	123	123	120	114	87				
1000	111	119	115	114	109	116	123	119	113	86				
1250	106	120	117	112	106	120	120	117	113	84				
1600	113	123	117	114	109	119	124	116	116	85				
2000	110	121	117	116	110	121	124	119	116	83				
2500	110	122	115	116	110	116	121	116	115	81				
3150	106	120	114	116	108	117	118	116	114	82				
4000	109	122	115	117	107	119	119	116	114	79				
5000	109	121	113	115	105	114	117	114	112	76				
6300	110	121	112	115	106	115	117	113	111	76				
8000	111	122	112	115	108	114	116	113	112	63				
10000	107	119	109	111	103	111	113	111	106	79				
12500	107	120	109	112	99	111	112	110	108	79				
16000	105	116	107	111	100	109	110	106	107	77				
OVERALL	122	132	129	127	121	132	134	130	126	112				

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											
OCTAVE BAND											
NOISE SOURCE/SUBJECT: ( OPERATION: )											
UH-1N HELICOPTER											
INFLIGHT NOISE LEVELS											
IDENTIFICATION: )											
OMEGA 3.2											
TEST 71-014-061											
RUN 01											
10 JAN 75											
PAGE J1											
LOCATION/CONDITION											
1/A 1/B 1/C 1/D 1/E 1/F 1/G 1/H 1/I 1/J											
FREQ (HZ)											
MIN MAX											
31.5	76	79	100	103	104	108	110	116	113	113	117
63	84	80	95	98	101	104	103	105	105	104	115
125	87	84	88	90	100	99	96	98	101	97	115
250	81	82	87	89	97	98	92	93	99	93	121
500	73	82	85	87	95	95	91	93	93	92	120
1000	69	75	88	91	91	92	89	92	89	90	121
2000	67	71	80	85	92	91	89	92	88	90	124
4000	61	69	79	83	86	85	83	86	83	85	121
8000	56	67	86	89	89	88	87	84	84	85	118
16000	48	62	70	76	88	83	82	82	82	83	113
OVERALL	90	89	102	105	108	111	111	116	114	114	130

TABLE: MEASURED SOUND PRESSURE LEVEL (08)												IDENTIFICATION:	
2												OMEGA 3.2	
												TEST 71-014-061	
												RUN 02	
NOISE SOURCE/SUBJECT:													
( OPERATION:													
(													
UH-1N HELICOPTER												10 JAN 75	
( INFLIGHT NOISE LEVELS													
(													
(												PAGE J2	

MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:	
3											
NOISE SOURCE/SUBJECT:	( OPERATION: )									OMEGA 3.2	
	( )									TEST 71-014-061	
	( )									RUN 01	
UH-1N HELICOPTER	( )									28 APR 76	
INFLIGHT NOISE LEVELS	( )									PAGE H1	
	( )										

